

1 Please add the following new claim 20.

2 20. (Newly added) A process for the manufacture of a substrate
3 according to claim 14, wherein the mixed amorphous silica fibres comprise one or more
4 micro-fine amorphous silica fibres and one or more chopped strands of amorphous silica.

REMARKS

Status of the Claims

Claims 1-19 were pending in this application. With this amendment, the applicants are amending claims 1, 10, and 14 and claim 20 has been added. Thus, claims 1-20 are the pending claims in this application.

Summary of the Office Action

In the Office Action dated January 2, 2003, claims 1, 2, 6-10, 12, 13, 17, and 18 were rejected under 35 U.S.C. § 102(b) as anticipated by Stonehart et al (US 5,523,181). Claims 14, 15, 16, and 19 were rejected under 35 U.S.C. § 102 (b) as anticipated by Denton et al. (US 6,042,958). Claims 3-5 and 11 were rejected under 35 U.S.C. § 103 (a) as being unpatentable over Stonehart '181 in view of Denton '958.

Rejection Under 35 U.S.C. § 102 (b)

Claims 1, 2, 6-10, 12, 13, 17, and 18 stand rejected under 35 U.S.C. § 102(b). Specifically, the Examiner indicates that Stonehart '181 anticipates the invention, as set forth in those claims. The Examiner states that Stonehart '181 discloses a substrate or a composite membrane comprising a porous matrix of amorphous silica fibres bound by a binder (as in claims 1 and 2) and having an ion-conducting polymer (as in claims 8 and 10) for use in a composite membrane (as in claim 9) or fuel cell (as in claim 13). See page 2 of the Office Action (citing column 3, lines 43-53 and column 4, lines 15-54). The Examiner also states that Stonehart '181 discloses silica fibers of 6-micron diameter (as in claims 6 and 7), and membrane thickness >200 microns (as in claims 12), a membrane electrode assembly and a fuel cell (as in claims 17 and 18). See pages 2 and 3 of Office Action (citing column 3, lines 43-53, column 4, lines 28-33, and column 4, lines 35-29). For the reasons set forth below, the applicants respectfully submit that claims 1, 2, 6-10, 12, 13, 17, and 18 are not anticipated by Stonehart '181.

In response to this rejection, claim 10 has been amended to replace the phrase "a porous matrix" with the phrase "a porous non-woven sheet." Support for this amendment can be found in the examples at, for example, page 10, line 15. With this amendment, the applicants submit that Stonehart '181 fails to disclose all the features of the invention as claimed by newly amended claims 1 and 10.

The applicants note that Stonehart '181 discloses a polymer solid-electrolyte composition that contains silica particles and/or silica fiber. See column 4, lines 5-48. Additionally, Stonehart '181 discloses that it is important "to make the polymer solid electrolyte contain the silica evenly." See column 4, lines 19-20. Therefore, in the invention disclosed in Stonehart '181, the silica is dispersed evenly throughout the polymer membrane and not in the form of a non-woven fibre sheet as in the present invention. That Stonehart '181 fails to disclose the substrate of claim 1 or the membrane of claim 10 is confirmed by the manner in which the electrolyte compositions of Stonehart are made. See col. 4, line 55 through column 5, line 4. This method involves mixing a solution of the polymer in a solvent with a dispersion of silica. That mixture is then poured into a molding vessel and dried. This method of manufacture does not result in a substrate comprising a porous non-woven sheet of fibres bound by a binder as called for by claim 1 or a membrane comprising such a substrate and at least one ion-conducting polymer.

Moreover, Stonehart '181 discloses that the silica particles and fibres are incorporated for their water retaining abilities. See column 3, lines 66-67 and column 4, lines 1-4. The invention disclosed by Stonehart '181 is directed to providing a polymer solid-electrolyte composition "having increased water content and an improved ion conductivity as well as decreased specific resistance." See Column 3, lines 14-19. Further, Stonehart '181 does not suggest that the silica particles and fibres should be bound together as a non-woven sheet that can be incorporated into a membrane in order to reinforce the membrane structure, thereby conferring dimensional stability as in the present invention. For the reasons set forth above, the applicants respectfully request withdrawal of this rejection.

Claims 14, 15, 16, and 19 stand rejected under 35 U.S.C. § 102 (e). The Examiner states that the invention, as set forth in those claims, is anticipated by Denton '958. Specifically, the Examiner indicates that Denton '958 discloses a process for the manufacture of a substrate comprising dispersing mixed silica fibers in water to form a slurry; depositing the slurry on a mesh bed; applying a binder for the impregnation; and

drying and compacting. See page 3 of the Office Action dated January 2, 2003 (citing column 6, lines 14-46). The Examiner also states that the impregnation may be carried out by the use of a nip roller coating (as in claim 16) and that the fibers are randomly oriented in the substrate (as in claim 19). See page 3 of the Office Action (citing column 6, lines 8-46). For the reasons set forth below, the applicants respectfully submit that claims 14, 15, 16 and 19 are not anticipated by Denton '958.

The applicants respectfully disagree that Denton '958 discloses all the features of the invention as claimed by claim 14. The claimed invention utilizes different fibres from the type of fibres disclosed in Denton '958 to form the substrate. In particular, claim 14 is directed to a process for the manufacture of a substrate wherein the fibres are "**mixed amorphous silica fibres**." Denton '958 discloses that the fibres which are suitable for use include "glass, polymer, ceramic, quartz, silica, carbon or metal fibres" and are "preferably of glass, ceramic, or quartz." See column 3, lines 5-13. Although "silica" is mentioned in Denton '958, this cannot be read to encompass "mixed amorphous silica fibres" for the reasons discussed below. Accordingly, the type of fibres utilized in the present invention, mixed amorphous silica fibres, are distinguishable from the types of fibres utilized in the invention disclosed in Denton '958.

To explain the basis for distinction, the applicants refer to the application which discloses that the amorphous silica to be used in the present invention is distinguished from crystalline quartz. At pages 3 and 4, the present application states: "there is a tendency in an industrial context for the terms "quartz" and "silica" to be used interchangeably." Also, the applicants submit that the term "silica" is defined as follows in the chambers Dictionary of Science and Technology: "Dioxide [(IV) oxide] of silicon, SiO_2 , occurring in crystalline forms as quartz, cristobalite, tridymite; as cryptocrystalline chalcedony; as amorphous opal; and as an essential constituent of the silicate groups of minerals."

Denton '958, does not disclose or even suggest that the fibres themselves should be "amorphous." In fact, Denton '958 discloses that depending on the characteristics of the membrane required for specific applications or conditions, "it may be advantageous to **coat** the fibres with one or more different materials." See column 5, lines 18-23. Specifically, Denton '958 discloses that the fibres may be coated with "non ion-conducting polymers to change their surface characteristics" such as "amorphous silica to produce a more hydrophilic surface." See column 5, lines 28-32. Significantly, only with respect to this step of coating the fibres does Denton '958 mention, for the first time, *amorphous*

silica. In view of this specific mention of amorphous silica as a coating but only with respect to a coating, Denton '958 cannot be read to include fibres which themselves are amorphous silica.

Moreover, Denton '958 certainly cannot be read as disclosing "mixed" amorphous silica fibres, as called for by claim 14. Additionally, the applicants submit that not only is newly added claim 20 patentable as it is based on independent claim 14, but claim 20 is patentable because it recites that the mixed amorphous silica fibres comprise one or more micro-fine amorphous silica fibres and one or more chopped strands of amorphous silica. Support for this amendment can be found on page 4, lines 4-7 of the present application. For the reasons above, it is submitted that Denton '958 does not disclose the use of amorphous silica as the fibres, so certainly there is no disclosure or even contemplation in Denton '958 of the use of one or more micro-fine amorphous silica fibres and one or more chopped strands of amorphous silica in the invention as claimed.

Thus, the applicants submit that Denton '958 does not anticipate the present invention. Accordingly, the applicants respectfully request withdrawal of the rejection of claim 14 and its dependent claims 15, 16, and 19.

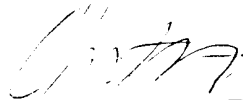
Rejections Under 35 U.S.C. § 103 (a)

Claims 3-5 and 11 stand rejected under 35 U.S.C. § 103 (a). Specifically, the Examiner states that the present invention is unpatentable over Stonehart '181 in view of Denton '958. The applicants note that claims 3-5 are dependent on claim 1 and claim 11 is dependent on claim 10. Claims 1 and 10 are believed to be patentable for the reasons discussed above. Nothing in the rejection of dependent claims 3-5 and 11 is responsive to the basis for distinction set forth above. Therefore, the applicants submit that dependent claims 3-5 and 11 are patentable and respectfully request withdrawal of this rejection.

CONCLUSION

The applicants submit that the pending claims are in condition for allowance. All grounds for objection or rejection have been overcome by the present amendment. Additionally, amendments made to the claims have full support in the specification and no new matter has been added. For all of these reasons, the applicants respectfully submit that the rejections under 35 U.S.C. §§102 (b) and 103(a) should be withdrawn and favorable action is earnestly solicited.

Respectfully Submitted,



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Enclosures: Version with markings to show changes made

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Christopher R. Lewis

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VERSION WITH MARKINGS TO SHOW CHANGES MADEIN THE CLAIMS:

Claims 1, 10, and 14 have been amended.

1 1. (Once amended) A substrate, suitable for the preparation of a
2 composite membrane, which substrate comprises a porous [matrix] non-woven sheet of
3 fibres, characterised in that the fibres comprise mixed amorphous silica fibres that are
4 bound with a binder.

1 10. (Twice amended) A composite membrane comprising a porous
2 substrate of fibres and at least one ion-conducting polymer, characterised in that the
3 substrate comprises a porous [matrix] non-woven sheet of mixed amorphous silica fibres
4 bound with a binder.

1 14. (Twice Amended) A process for the manufacture of a substrate,
2 comprising the steps of

- 3 (a) dispersing mixed amorphous silica fibres in water to form a slurry;
4 (b) depositing the slurry onto a mesh bed to form a fibre network;
5 (c) drying and compacting the fibre network; and
6 (d) applying, before or after step (c), a dispersion of binder.